Claims 50 and 53 have been amended for the sole purpose of correcting grammatical errors.

The Examiner has rejected claims 25, 42, 49, 50 and 51 under 35 USC § 103(a) as being unpatentable over the patent to Peng. This rejection is respectfully traversed.

As described in the previous Amendment filed on May 8, 2001, the present invention is directed to a focusing device used to quickly focus 2D coded symbologies. A multiple line charge coupled device (CCD) detector 93 is included along with a focusing disc 94 provided with a series of different thickness optical positions 132 to allow different focal lengths to be quickly scanned. The CCD detector 93 generates image data as 494 lines, one line at a time. However, to accelerate the focusing process, the first 246 lines are dumped instead of being digitized and the next 10 lines are the only lines utilized in the analysis to determine the optimal focus. The remaining lines are never read. Additionally, it is noted that the present invention utilizes a non-holographic light transmissive focusing apparatus capable of being utilized with any coherent or incoherent light source.

The patent to Peng is directed to a device utilizing a reflective focusing apparatus to obtain the focal length change. Additionally, the Peng patent, as described in column 2, lines 26-50, employs a symmetrical lens system that can only operate with small aberrations at magnifications near 1:1. When used at magnifications not near 1:1, a symmetrical lens can be a severe disadvantage. Furthermore, as illustrated in Figure 5, light generated from a laser 10 would first pass through a lens system 1 before being directed to the reflection means 2 including a rotating wheel 4. After being reflected by the wheel 4, the laser beam passes again through the lens system 1 and through a beam splitter 12 before being impinged upon a sweep generator 13 which directs the laser beam to a bar code C. Figure 6 shows a system in which the light from the bar code C is forced to pass through the lens 1 twice. The present system does not force the use of a symmetrical optical configuration and therefore can provide relatively small aberrations with any type

of lens arrangement, symmetrical or not. During focusing, as indicated hereinabove, the CCD disposes of a first set of multiple lines at a first rate of speed and then samples the central set of lines at a second rate of speed less than the first rate of speed. As admitted by the Examiner in the present rejection, Peng would evaluate all of the scan lines. The present invention as presently recited in claim 25, scans the central set of lines at a lower speed than the first set of multiple lines. This feature has been included in claim 25, and claim 26 has been cancelled without prejudice. It is believed that this feature is not anticipated or suggested by the Peng reference. Therefore, it is believed that claim 25, as amended, recites allowable subject matter. Since claims 27, 36, 42, 49, 50 and 51 depend from claim 25, it is believed that these claims also recite patentable subject matter and should be allowed.

The Examiner has rejected claims 40, 41, 43 and 46 under 35 USC § 103(a) as being unpatentable over Peng in view of the patent to Parulski et al. This rejection is respectfully traversed.

The patent to Parulski et al describes an electronic camera with rapid automatic focus of an image upon an image sensor. A flowchart showing the sequence of operations of the camera shown in Figure 1 is illustrated in Figure 6. As specifically indicated in column 5, lines 61-67, and column 6, lines 1-5, "The camera focus is adjusted to a mid range position while the shutter 24 is opened and the sensor 20 is cleared of any charge using the fast flush operating mode for the entire sensor. An image, to be used for focusing the camera lens, is then integrated for a period of time, for example 10 mSec. During this imaging cycle, the shutter 24 remains open while a top portion of the image is rapidly read out and discarded, using "fast flush" clocking where the vertical and horizontal registers are continuously clocked. The vertical clock sequence is then returned to the normal readout operation, while a small number of lines in the center region 66 of the image are clocked out." This indicates that Parulski et al uses a shutter that stays open while a plurality of CCD images are being processed during the

time that the lens is being focused. During this time, the data is being shifted from the CCD at a rapid rate, even during the time that the central portion of the images are being processed. This is in contradistinction to the present invention which shifts out the central portion of the image to evaluate the best focus at a slower speed to obtain the benefit of a higher quality signal. This feature is recited in both independent claims 25, as well as new claim 55, depending from claim 44. Additionally, the present invention utilizes an electronic shutter which is only open for a short time during each of a plurality of images to avoid image smear. It is noted that the Parulski et al patent employs a mechanical shutter that stays open while a plurality of CCD images are being processed. Therefore, it is believed that independent claim 25 which indicates that the central set of scan lines is sampled at a rate less than the rate of a first set of scan lines. Consequently, reconsideration and allowance of these claims are respectfully urged.

The Examiner has rejected claim 27 under 35 USC § 103(a) as being unpatentable over Peng in view the patent to England. This rejection is respectfully traversed.

Claim 27 depends directly from claim 25 and includes the limitations described hereinabove. Therefore, reconsideration and allowance of this claim is earnestly solicited.

The Examiner has rejected claims 44, 47 and 52-54 under 35 USC § 103(a) as being unpatentable over Broockman et al in view of the admitted prior art. This rejection is respectfully traversed.

The patent to Broockman et al describes a holographic scanner having an adjustable sampling rate. The utilization of this holographic scanner would limit it to coherent light sources such as those from a laser. The present invention does not utilize holographic elements and would operate with any coherent or incoherent light source. It is noted that claim 44 has been amended to specifically indicate that a non-holographic light transmissive focusing apparatus would be employed. Therefore, reconsideration and withdraw of this rejection are earnestly solicited.

The Examiner has rejected claims 45, 46 and 48 based upon the patents to Broockman et al, England or Parulski et al (claim 48). These rejections are respectfully traversed.

It is believed that these claims are not anticipated or suggested by the prior art for the reasons described hereinabove. Therefore, reconsideration and withdraw of this rejection are respectfully urged.

It is believed that the application as presently amended is not anticipated or suggested by the prior art. Therefore, reconsideration and allowance of this application are earnestly solicited.

Respectfully submitted,

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WHAT IS CLAIMED IS:

1. An optical symbology imager, comprising:

a two dimensional photodetector having an active area for capturing an image of said optical symbology;

a focusing means for providing at least two focusing zones of said optical symbology; and

a control means for controlling said focusing means and said two dimensional photodetector to determine an optimum focus state,

wherein said focusing means is controlled by said control means to provide image data to said two dimensional photodetector for each of said at least two focusing zones,

said active area of said two dimensional photodetector shifting out said image data serially, and storing a central portion of said image data in a memory in said control means,

said control means evaluating transitions between light and dark data in said central portion of said image data to produce a representative value for each of said at least two focusing zones, wherein a largest representative value indicates which of said focusing zones provides the best focus.

2. An optical symbology imager as recited in claim 1, wherein said two dimensional photodetector is a CCD.

3. An optical symbology imager as recited in claim 2, wherein said CCD disposes of a first set of multiple scan lines, and then samples said central portion.

4. An optical symbology imager as recited in claim 3, wherein said CCD has a resolution of 659 by 494 in said active area.

5. An optical symbology imager as recited in claim 1, wherein said representative value is produced by totaling a high frequency subset of values produced from a complete set of frequency values for each of said multiple focusing zones.

6. An optical symbology imager as recited in claim 3, wherein said representative value is produced by totaling a high frequency subset of values produced from a complete set of frequency values for each of said multiple focusing zones.

7. An optical symbology imager as recited in claim 1, wherein said control means is a microprocessor.

8. An optical symbology imager as recited in claim 1, wherein said focusing means provides twelve focusing zones.

9. An optical symbology imager as recited in claim 8, wherein said focusing means comprises a focusing disk having twelve optical positions, said focusing disk being rotatable so that each of said twelve optical positions can be moved into an optical axis of said imager, said two dimensional photodetector performing image capture for each of said twelve optical positions.

10. An optical symbology imager as recited in claim 1, further comprising an illumination means for providing variable illumination of said optical symbology.

11. An optical symbology imager as recited in claim 10, wherein said two dimensional photodetector receives said image data for multiple illumination conditions, as provided by said illumination means, said control means calculates edge totals for each image and optimum illumination is determined for one of said multiple illumination states having a largest edge total.

12. An optical symbology imager, comprising

a two dimensional photodetector having an active area for capturing an image of said optical symbology;

an illumination means for providing variable illumination of said optical symbology; and

control means for controlling said illuminating means and said two dimensional photodetector to determine optimum illumination, said illumination means providing multiple illumination conditions, said two dimensional sensor receiving image data for each of said multiple illumination conditions, said control means calculating edge totals for each image data received by said two dimensional photodetector comparing said edge totals and utilizing a largest of said edge totals as an indicator of said optimum illumination.

13. An optical symbology imager as recited in claim 12 wherein said two dimensional photodetector is a CCD.

14. An optical symbology imager as recited in claim 13, wherein said CCD disposes of a first set of multiple scan lines, and then samples said central portion.

15. An optical symbology imager as recited in claim 14, wherein said CCD has a resolution of 659 by 494 in said active area.

16. An optical symbology imager as recited in claim 12, wherein said control means is a microprocessor.

17. An optical symbology imager as recited in claim 10, wherein said illumination means comprises a dark field illuminator and a bright field illuminator.

18. An optical symbology imager as recited in claim 17, wherein said dark field illuminator comprises multiple light emitting diodes facing away from said optical symbology.

19. An optical symbology imager as recited in claim 17, wherein said bright field illuminator comprises multiple light emitting elements facing said optical symbology.

20. An optical symbology imager as recited in claim 18, wherein said bright field illuminator comprises multiple light emitting elements facing said optical symbology.

21. An optical symbology imager as recited in claim 12, wherein said illumination means comprises a dark field illuminator and a bright field illuminator.

22. An optical symbology imager as recited in claim 21, wherein said dark field illuminator comprises multiple light emitting diodes facing away from said optical symbology.

23. An optical symbology imager as recited in claim 21, wherein said bright field illuminator comprises multiple light emitting elements facing said optical symbology.

24. An optical symbology imager as recited in claim 23, wherein said bright field illuminator comprises multiple light emitting elements facing said optical symbology.

Sub C1

25. (Twice Amended) An optical symbology imager, comprising:

a multiple line charge coupled device (CCD) having an active area;

a focusing apparatus comprising a focusing disk with multiple optical positions to provide different focal lengths, said disk being rotatable so that each of said multiple optical positions can move into an optical path of said imager;

a microprocessor for controlling said focusing apparatus and operation of said CCD, so that said CCD performs image capture producing image data for each of said multiple optical positions;

C1 B6a

said microprocessor controlling said CCD to shift out said image data substantially serially;

said microprocessor evaluating transitions between light and dark data in a central set of multiple lines to produce a representative value for each of said multiple optical positions, wherein a largest representative value corresponds to one of said optical positions producing optimum focus; and

wherein said CCD disposes of a first set of multiple lines at a first rate of speed during focusing, and then samples a second subsequent set of multiple lines from said central set of scan lines at a second rate of speed less than said first rate of speed during focusing.

B7 Sub C2

27. (Amended) An optical symbology imager as recited in claim 25, wherein said representative value is produced by totaling a first seven to ten values from multiple values produced for each of said multiple focusing positions.

28. A method of reading an optical symbology comprising the steps of:

capturing an image of said optical symbology in an active area of a two dimensional photodetector;

providing at least two focusing zones of said optical symbology,

controlling said two dimensional photodetector to receive said image of said optical symbology for each said two focusing zones in said active area;

said active area of said two dimensional photodetector shifting out said image data substantially serially, and

evaluating transitions between light and dark data in a central set of scan lines, producing a representative value for each of said at least two focusing zones, and determine optimum focus based upon a largest of said representative values.

29. A method of reading an optical symbology as recited in claim 28, wherein said central set of lines is ten lines.

30. A method of reading an optical symbology as recited in claim 28, further comprising the step of producing said representative value by adding a first seven to ten values from a complete set of frequency values for each of said multiple focusing zones.

31. A method of reading an optical symbology as recited in claim 28, wherein said multiple focusing zones are twelve zones.

32. A method of reading an optical symbology as recited in claim 28, wherein said focusing step comprises the step of changing between said multiple focusing zones.

33. A method of reading an optical symbology comprising the steps of:

providing multiple illumination conditions of said optical symbology;

capturing an image of said optical symbology in an active area of a two dimensional photodetector for each of said multiple illumination conditions,

determining optimum illumination by calculating edge totals for each image data received by said two dimensional photodetector;

comparing said edge total for all of said multiple illumination conditions to determine a largest edge total, and

utilizing said largest edge total as an indicator of optimum illumination.

34. An optical symbology imager as recited in claim 1, wherein said optical symbology imager is hand-held.

35. An optical symbology imager as recited in claim 12, wherein said optical symbology imager is hand-held.

36. An optical symbology imager as recited in claim 25, wherein said optical symbology imager is hand-held.

37. An optical symbology imager as recited in claim 8, wherein said focusing means comprises a focusing disk having multiple optical positions, said focusing disk being rotatable so that each of said multiple optical positions can be moved into an optical axis of said imager, said two dimensional photodetector performing image capture for each of said multiple optical positions.

38. An optical symbology imager as recited in claim 15, wherein said first set of multiple lines is 246 lines.

39. An optical symbology imager as recited in claim 15, wherein said second set of scan lines is substantially ten lines.

Sub B3 C3

40. (Twice Amended) An optical symbology imager as recited in claim 25, wherein said first set of multiple lines is 246 lines.

41. (Twice Amended) An optical symbology imager as recited in claim 25, wherein said second set of multiple lines is substantially ten lines.

42. An optical symbology imager in accordance with claim 25 wherein said multiple line CCD has a resolution of 659 by 494.

43. An optical symbology imager in accordance with claim 25, wherein said microprocessor only utilizes said central set of multiple lines to produce the optimum focus.

B4 C4

44. (Amended) An optical symbology imager comprising:

a non-holographic light transmissive focusing apparatus comprising a focusing disk with multiple optical positions to provide different focal lengths, said disk being rotatable so that each of said multiple optical positions can move into an optical path of said imager;

a microprocessor for controlling said focusing apparatus and operation of a multiple line charge coupled device, so that said CCD performs image capture producing image data for each of said multiple optical positions;

said microprocessor controlling said CCD to shift out said image data substantially serially; and

said microprocessor evaluating transitions between light and dark data in a central set of multiple lines to produce a representative value for each of said multiple optical positions, wherein a largest representative value corresponds to one of said optical positions producing optimum focus.

B4 cont

45. (Amended) An optical symbology imager in accordance with claim 44, wherein said representative value is produced by totaling a first seven to ten values from multiple values produced for each of said multiple focusing positions.

47. An optical symbology imager in accordance with claim 44, wherein said multiple line CCD has a resolution of 659 by 494.

48. An optical symbology imager in accordance with claim 44, wherein said microprocessor only utilizes said central set of multiple lines to produce the optimum focus.

B5 Sub CP

49. (Amended) An optical symbology imager in accordance with claim 25, wherein said multiple optical positions are at least two.

50. (Amended) An optical symbology imager in accordance with claim 25, wherein said multiple optical positions are eight.

51. (Amended) An optical symbology imager in accordance with claim 25, wherein said multiple optical positions are twelve.

B5 Concl'd

52. (Amended) An optical symbology imager in accordance with claim 44, wherein said multiple optical position are at least two.

53. (Amended) An optical symbology imager in accordance with claim 44, wherein said multiple optical positions are eight.

54. (Amended) An optical symbology imager in accordance with claim 44, wherein said multiple optical positions are twelve.

B6

55. (New) An optical symbology imager in accordance with claim 44, wherein said CCD disposes of a first set of multiple lines at a first rate of speed during focusing and then samples a second subsequent set of multiple lines from said central set of scan lines at a second rate of speed less than said first rate of speed during focusing.